We claim:

1. A nanoparticle comprising:

a. an inner layer including alkenylbenzene monomer units,

b. an outer layer including monomer units selected from the group consisting of conjugated diene, alkylene, alkenylbenzene, and mixtures thereof; and

c. at least one functional group associated with the outer layer;

wherein said nanoparticle has a mean average diameter of less than about 100 nm.

2. The nanoparticle of claim 1 wherein said nanoparticle is substantially monodisperse.

3. The nanoparticle of claim 1 wherein said conjugated dienes are selected from the group consisting of C_4-C_8 conjugated dienes and mixtures thereof.

4. The nanoparticle of claim 1 wherein said alkenylbenzene monomer units are selected from the group consisting of styrene, α-methyl styrene, 1-vinyl naphthalene, 2-vinyl naphthalene, 1-α- methyl vinyl naphthalene, 2-α-methyl vinyl naphthalene, vinyl toluene, methoxystyrene, t-butoxystyrene, and the like, as well as alkyl, cycloalkyl, aryl, alkaryl, and aralkyl derivatives thereof, in which the total number of carbon atoms in the combined hydrocarbon is not greater than 18, as well as any di- or tri-substituted aromatic hydrocarbons, and mixtures thereof.

5. The nanoparticle of claim 1 wherein said alkylene monomer units are formed by hydrogenating said conjugated diene monomer units.

6. The nanoparticle of claim 1 wherein said functional group is polar.

7. The nanoparticle of claim 1 wherein said functional group is selected from the group consisting of maleic anhydride, amine, azo, carboxylic acid, epoxide, amino, and mixtures thereof.

8. The nanoparticle of claim 1 wherein said nanoparticles are crosslinked.

9. The nanoparticle of claim 1 wherein said inner layer further includes conjugated diene monomer units.

10. A process for forming polymer nanoparticles comprising:

a. polymerizing alkenylbenzene monomer and conjugated diene monomer in a hydrocarbon solvent to form a diblock polymer;

b. forming micelles of said diblock polymer;

c. adding at least one crosslinking agent to the micelles to form crosslinked nanoparticles having an inner layer including alkenylbenzene monomer units and an outer layer including monomer units selected from the group consisting of alkenylbenzenes, conjugated dienes, and mixtures thereof, and

d. combining said nanoparticles with at least one functional group to form functionalized nanoparticles.

11. The process of claim 10 wherein step a is performed in the presence of a lithium initiator.

12. The process of claim 10 further including a hydrogenation step.

13. The process of claim 10 wherein said conjugated diene monomer units are selected from the group consisting of C_4-C_8 conjugated dienes and mixtures thereof.

14. The process of claim 10 wherein said alkenylbenzene monomer units are selected from the group consisting of styrene, α-methyl styrene, 1-vinyl naphthalene, 2-vinyl naphthalene, 1-α- methyl vinyl naphthalene, 2-α-methyl vinyl naphthalene, vinyl toluene, methoxystyrene, t-butoxystyrene, and the like, as well as alkyl, cycloalkyl, aryl, alkaryl, and aralkyl derivatives thereof, in which the total number of carbon atoms in the combined hydrocarbon is not greater than 18, as well as any di-or tri-substituted aromatic hydrocarbons, and mixtures thereof.

15. The process of claim 10 wherein said functional group is polar.

16. The process of claim 10 wherein said functional group is selected from the group consisting of maleic anhydride, amine, azo, carboxylic acid, epoxide amino and mixtures thereof.

17. The process of claim 10 wherein step d is performed before step c.

18. A rubber composition comprising:

a. a rubber;

b. a polymer nanoparticle including a poly(alkenylbenzene) core; an outer layer including monomer units selected from the group consisting of conjugated dienes, alkenylbenzenes, alkylenes, and mixture thereof; and at least one functional group associated with said surface layer; and

c. at least one filler.

19. The composition of claim 18 wherein said rubber is selected from the group consisting of synthetic polyisoprene rubber, styrene-butadiene rubber (SBR), styrene-isoprene rubber, styrene-isoprene-butadiene rubber, butadiene-isoprene rubber, polybutadiene, butyl rubber, neoprene, acrylonitrile-butadiene rubber (NBR), silicone rubber, the fluoroelastomers, ethylene acrylic rubber, ethylene-propylene rubber, ethylene-propylene terpolymer (EPDM), ethylene vinyl acetate copolymer, epichlorohydrin rubber, chlorinated polyethylene-propylene rubbers, chlorosulfonated polyethylene rubber, hydrogenated nitrile rubber, tetrafluoroethylene-propylene rubber, and mixtures thereof.

20. The composition of claim 18 wherein said functional group is selected from the group consisting of maleic anhydride, amine, azo, carboxylic acid, epoxide amino and mixtures thereof.

21. The composition of claim 18 wherein said filler is selected from the group consisting of carbon black, wet silica, dry silica, calcium silicate, aluminum silicate, magnesium silicate, and mixtures thereof.

22. A tire comprised of the rubber composition of claim 18 wherein said polymer nanoparticles is complexed with a metal.

23. A rubber, including a polymer nanoparticle including a poly(alkenylbenzene) core, an outer layer including monomer units selected from the group consisting of conjugated dienes, alkenylbenzenes, alkylenes, and mixtures thereof, at least one functional group associated with said surface layer, and a metal complexed with said functional group and at least one filler.